

PCT/INTERNATIONAL COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

KOLSTER OY AB
Iso Roobertinkatu 23
P.O. Box 148
FIN-00121 Helsinki
FINLANDE

Date of mailing (day/month/year) 17 January 2002 (17.01.02)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 2990548PC/su	
International application No. PCT/FI00/00815	International filing date (day/month/year) 22 September 2000 (22.09.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address NOKIA NETWORKS OY Keilalahdentie 4 FIN-02150 Espoo Finland	State of Nationality FI	State of Residence FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name	<input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence
Name and Address NOKIA CORPORATION Keilalahdentie 4 FIN-02150 Espoo Finland	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary:		
4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned	
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Jaime LEITAO
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 28 May 2001 (28.05.01)	
International application No. PCT/FI00/00815	Applicant's or agent's file reference 2990548PC/su
International filing date (day/month/year) 22 September 2000 (22.09.00)	Priority date (day/month/year) 24 September 1999 (24.09.99)
Applicant EIKKULA, Jari	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
12 March 2001 (12.03.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Claudio Borton Telephone No.: (41-22) 338.83.38
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 07 DEC 2001

WIPO

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Applicant's or agent's file reference 2990548PC/nu	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI00/00815	International filing date (day/month/year) 22.09.2000	Priority date (day/month/year) 24.09.1999
International Patent Classification (IPC) or national classification and IPC ₇ H 04 B 3/23		
Applicant NOKIA NETWORKS OY ET AL.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 12.03.2001	Date of completion of this report 30.11.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 33	Authorized officer Rune Bengtsson/AE Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00815

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☒ the international application as originally filed
- ☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description. pages _____
- ☐ the claims. Nos. _____
- ☐ the drawings. sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00815

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-22</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-22</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-22</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

D1: EP 920172 A1

D2: US 5953658 A

D1 discloses a method of controlling an echo canceller by a user of the subscriber unit. The user can send a request to switch an echo canceller on or off in a local exchange. In the present invention, the switching center is arranged to command the nearest switching center having the echo cancelling capacity to connect/disconnect echo canceller to/from the channel.

D2 discloses a method for training echo canceller during a training sequence of a data connection between a cellular cordless modem connected to cellular cordless phone and a PSTN modem. In D2 there are not a system with several switching centers.

The claimed invention according to the claims 1-22 is new in view of D1 or D2 and involves an inventive step.

Also the requirement of industrial applicability is fulfilled.

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2990548PC/su

PCT REQUEST

Original (for SUBMISSION) - printed on 22.09.2000 12:31:05 PM

0	For receiving Office use only	
0-1	International Application No.	PCT/FI 0 0 / 0 0 8 1 5
0-2	International Filing Date	2 2 SEP 2000 (2 2 -09- 2000)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	2990548PC/su
I	Title of invention	CONTROL OF ECHO CANCELLERS IN A TELECOMMUNICATIONS SYSTEM
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA NETWORKS OY
II-5	Address:	Keilalahdentie 4 FIN-02150 Espoo Finland
II-6	State of nationality	FI
II-7	State of residence	FI
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	EIKKULA, Jari
III-1-5	Address:	Vahtirinne 3 B 1 FIN-00370 Helsinki Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

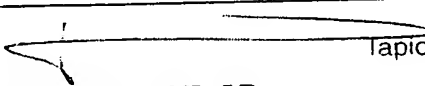
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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	KOLSTER OY AB
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IV-1-3	Telephone No.	+ 358 9 618 821
IV-1-4	Facsimile No.	+ 358 9 602 244
IV-1-5	e-mail	Kolster@Kolster.Fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR (patent and utility model) KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	24 September 1999 (24.09.1999)
VI-1-2	Number	19992054
VI-1-3	Country	FI
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)
VIII	Check list	number of sheets electronic file(s) attached
VIII-1	Request	4 -
VIII-2	Description	8 -
VIII-3	Claims	5 -
VIII-4	Abstract	1 2990548p.txt
VIII-5	Drawings	2 -
VIII-7	TOTAL	20
VIII-8	Accompanying items	paper document(s) attached electronic file(s) attached
VIII-9	Fee calculation sheet	✓ -
VIII-10	Separate signed power of attorney	✓ -
VIII-16	PCT-EASY diskette	- diskette
VIII-17	Other (specified):	Copy of Official Action -
VIII-18	Figure of the drawings which should accompany the abstract	3
VIII-19	Language of filing of the international application	English
IX-1	Signature of applicant or agent	 Japio Valkeiskangas
IX-1-1	Name	KOLSTER OY AB

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	22 SEP 2000	(22-09-2000)
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10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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19992054 24 September 1999 (24.09.1999) **FI**

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(72) Inventor; and

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(74) Agent: **KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).**

(81) Designated States (national): **AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.**

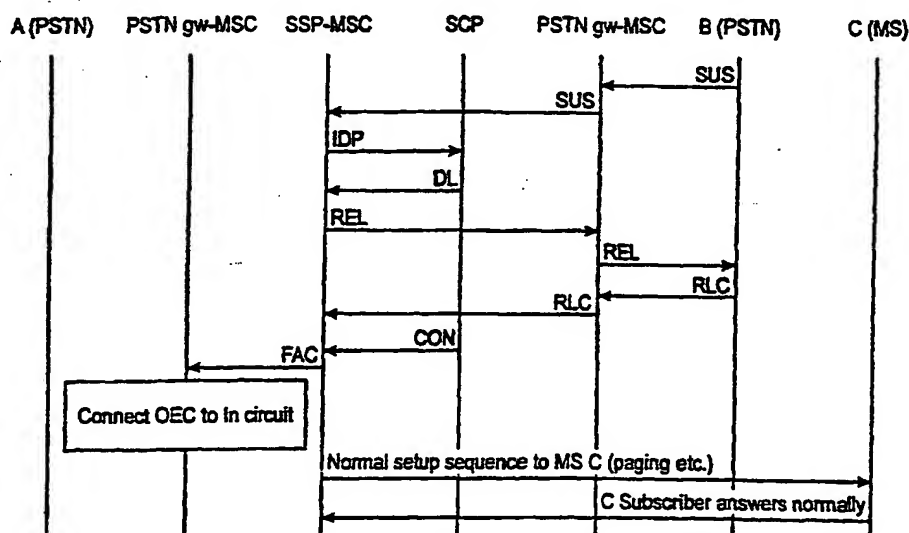
(84) Designated States (regional): **ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).**

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **CONTROL OF ECHO CANCELLERS IN A TELECOMMUNICATIONS SYSTEM**



(57) Abstract: The invention relates to a communications network, comprising switching centers (SSP/MSC) having no echo canceling equipment and switching centers (PSTN gw-MSC) having echo canceling equipment. The switching centers (SSP/MSC) are capable of changing the call party or the call during the call. The switching center (SSP/MSC) which controls the change of call party or call type is arranged to command (FAC) the nearest switching center (PSTN gw-MSC) having the echo canceling capability to connect/disconnect an echo canceling equipment to/from the connection. In other words, in these special situations the echo cancellation is controlled by a new signaling feature within the communications network. As a result, it is unnecessary to introduce echo canceling equipment into each switching center in the communications network for these special situations only.

WO 01/22612 A1

Control of echo cancellers in a telecommunications system

Field of the Invention

The invention relates to echo canceling, and more particularly, to
5 control of echo cancellers in telecommunication systems.

Background of the Invention

In telecommunications networks transferring speech, such as telephone networks and mobile communications systems, an echo may occur on
10 end-to-end connections, as the voice of the talking party is reflected from the network elements or the connection. The echo is disturbing if there is a significant delay on the end-to-end connection. The delay is usually a propagation delay which causes the echo especially in long-distance or international calls and in calls using satellite links. The delay may also result from digital signal
15 processing which is the main reason for echo in digital mobile communications systems. The echo is divided into two categories: an acoustic echo between the ear piece and the microphone over telephone and an electric echo caused in transmission and reception directions in communications systems. One of the main reasons behind the electric echo is hybrid circuits (two-wire-four-wire converters) located in local exchanges or remote subscribers' stages.
20

An echo canceller or an echo suppresser has conventionally been used to obviate problems caused by the echo. An echo canceller is a device for processing a speech signal. It estimates the echo and reduces it by subtracting the echo estimate from a signal returning from the echo path.

25 In mobile communications systems, the echo cancellers are typically included in the mobile terminals and mobile switching centers which provide a gateway to other network, such as the public switched telephone network PSTN. The mobile switching center providing a gateway to the PSTN is referred to as a PSTN gateway-MSC herein. In the MS-MS call both the terminals contain the
30 needed echo canceller device and the network elements involved in the call need not have any echo canceller. In the PSTN-MS call another echo canceller must be connected to the PSTN side of the call at the PSTN gateway-MSC while the other echo canceller is in the MS, or otherwise the echo is noticed in the mobile terminal.

35 An intelligent network is a flexible way to introduce new services into the telecommunications network. The intelligent network consists of service

control points (SCP), service switching points (SSP) and various other elements. The service switching point's (SSP) functionality is typically located in the switching center of a conventional communications network, such as the MSC or the GMSC in the GSM system. The SSP/MSC is then connected to the service control point (SCP) which contains the intelligent service programs. The call control of the MSC uses a basic call state model (BCSM) which contains various detection points (DP) for modeling the state of the call towards the SCP. One or more of the detection points may be provided with a service trigger for the desired IN service. When call establishment proceeds to the detection point in the BCSM, and there is an activated service trigger, the SSP/MSC sends a request to the SCP. The SCP responds with operations which control the functions of the SSP/MSC in such a way that the activated service can be provided.

The IN services or similar services (e.g. services initiated by a voice message service or a voice mail system VMS) may include call drop back, call drop back return, follow on call, and call party handling services. The call drop back mechanism allows subscriber A to make a call to the person who has left a message in the voice mail. The call will be "dropped" to some of the previous MSCs and rerouted to subscriber C. In this mechanism subscriber A does not have to release the original call and make a new call to subscriber C. Call drop back return is a re-establishment of the MSC-VMS/service node (VMS = Voice Mail Service) connection, when the connection to the subscriber C has been successful and when the subscriber C has hung up the phone. The call can then be forwarded again to another subscriber. The follow-on call is a feature that enables the user to make a series of service requests without going through the identification and authentication process before performing each requested service. The identification and authentication are performed only on the first service request of the series. This functionality may be enhanced with other capabilities, it may be used e.g. for the call drop back service. One further service is call party handling (CPH). The CPH operations allow to establish new call parties in a flexible manner or to remove parties from the call and control the cross-connections between the parties. All the above-mentioned services may involve change of the connection configuration during the call.

The echo problem can appear in some particular cases when the connection configuration is changed during the call. This problem arises if the original connection configuration does not reserve any echo canceller, but the new connection configuration would require one. This happens, for example,

when a PSTN-PSTN connection is changed to a PSTN-MS connection. The same problem also concerns private branch exchange (PBX) calls. As an example, let us assume that a call addressed to a mobile station MS is routed from the PSTN via a PSTN gateway mobile switching center (PSTN gw-MSC) to a serving mobile switching center (MSC) within a mobile network. Then, due to an activated call-forwarding-when-busy service, for example, the call is further routed from the serving MSC via the same or another PSTN gw-MSC to the PSTN. In a PSTN-PSTN call no echo canceller is reserved in the PSTN gw-MSC. Then, later during the call, when for instance the CPH is used, the connection configuration is changed by releasing the second (forward) PSTN leg and establishing a new connection leg to the called MS under control of the serving MSC. The new PSTN-MS call would require an echo canceller but the PSTN gw-MSC has not reserved any echo canceller for the call. Therefore, the MS subscriber will experience a disturbing echo. One solution to this problem would be to provide an echo canceller in each MSC so that the serving MSC can internally connect an echo canceller to a call connection while changing the connection configuration.

Similar problem may arise when the type of call is changed during an active call. For example, a call may be started in a speech mode requiring an echo canceller in the PSTN gw-MSC and then later be changed into a facsimile mode in which the echo canceller is not allowed. Thus, also switching between the speech mode and the fax mode during a call requires an echo canceller in each MSC so that the echo canceller can be connected to and disconnected from the call.

Disclosure of the Invention

An object of the present invention is to avoid the need for echo canceling equipment in each switching center in a communications network.

The invention relates to methods and communication networks as claimed in the attached independent claims. Preferred embodiments of the claims are disclosed in the dependent claims.

The basic idea of the invention is that the switching center which controls the change of the call party or the change of the call type is arranged to command the nearest switching center having the echo canceling capability, to connect/disconnect echo canceling equipment to/from the connection. In other words, in these special situations the echo cancellation is controlled by a

new signaling feature within the communications network. As a result, it is unnecessary to introduce echo canceling equipment into each switching center in the communications network for these special situations only.

The signaling may be performed by any signaling message which can be sent during an active call, e.g. a new signaling message defined for this special purpose, or an existing signaling message modified to carry the echo canceller control information according to the invention. In the preferred embodiment of the invention, an ISUP message, such as the ISUP Facility message, is provided with a new parameter for controlling the echo canceling.

Brief Description of the Drawings

In the following the invention will be described in great detail by means of the preferred embodiments with reference to the accompanying drawings, in which

Figure 1 is a block diagram illustrating a PSTN-PSTN call established via a serving SSP/MS in a mobile communications network,

Figure 2 is a block diagram illustrating a PSTN-MS call changed from the PSTN-MS call of Figure 1 by means of call party handling CPH, for example,

Figure 3 is a signaling diagram illustrating the signaling used for changing the connection configuration from Figure 1 to Figure 2 and the control of the echo canceller according to the present invention,

Figure 4 is a block diagram illustrating a speech/fax call between the MS and the PSTN, and

Figure 5 is a signaling diagram illustrating the change of the call type from speech to fax and vice versa, and the associated control of the echo canceller according to the present invention.

Preferred embodiments of the invention

The present invention can be applied to any telecommunications system in which the connection configuration or the call type or any other feature of the call is changed during the call so that the need for echo canceling arises or echo canceling cannot be used any more.

The preferred embodiments of the invention will be described below using the GSM mobile communication network as an example.

Referring now to Figure 1, the mobile switching center MSC is con-

ected to a service control point of the intelligent network and operates as a service switching point SSP. Although not shown in Figure 1, the MSC/SSP is connected to a base station system BSS which provides a radio connection for the mobile station MS. One or more of the mobile switching centers in the mobile network are gateway MSCs which comprise gateway functions for calls routed to external telecommunications networks and calls arriving from those networks. In Figure 1 there are two PSTN gw-MSCs connected to the PSTN. There are also at least two data bases, the home location register HLR and the visitor location register VLR in the network (not shown).

Figure 1 shows a PSTN-PSTN call connection configuration. This connection configuration may have resulted for example from a call made by the PSTN subscriber A via the PSTN gw-MSC to the SSP/MSC serving the addressed mobile station MSC (subscriber C). Then, for some reason, for example due to a call-forwarding-when-busy function, the second connection leg is not established from the SSP/MSC to the called MS but the call is routed via a second PSTN gw-MSC to a second PSTN subscriber (subscriber B). As a consequence, we have a connection comprising a first connection leg from the subscriber A to the serving SSP/MSC and a second connection leg from the serving SSP/MSC to the PSTN subscriber B.

Let us now assume that when the call is active and having a configuration as illustrated in Figure 2, the PSTN subscriber B who has a re-answer possibility initiates release of the call, and an ISUP release message SUS is sent via the PSTN gw-MSC to the SSP/MSC. Based on the follow-on call feature, for instance, the SSP/MSC sends an initial DP message (an INAP operation) in order to initiate a new IN service in the SCP. The SCP responds with a disconnect leg message DL. Disconnect leg is an INAP operation which enables the SCP to disconnect (release) a connection leg in a two-party or multiparty call. Upon receiving the message DL, the SSP/MSC sends an ISUP release-message REL via the PSTN gw-MSC to the PSTN. The terminating side will acknowledge the REL by a message RLC. As a result, the second leg from the SSP/MSC to the PSTN is released. It should be noted that the IN service initiated by the IDP message involves some sort of user interaction before the DL message is sent. For example, an announcement may be played to the subscriber A in order to prompt him to provide instructions on how the call should be rerouted. The instructions may be given orally or by DTMF (Dual Tone Multi Frequency) dialing. The announcement may be for

example: "Push number one for the secretary, number two for the voice mail", etc. It is also possible that the subscriber B, e.g. a voice message service, sends the number of the subscriber C to which the call should be rerouted in the release message REL. In the latter case the MSC can independently re-
5 route the call also when no IN network is involved (cf. The call dropback service).

After sending the message DL, the SCP sends a connect message CON to the SSP/MSC. Connect is an INAP operation which enables the SCP to provide a telephone number of the new subscriber C to which the call is to
10 be rerouted. The telephone number of the subscriber C may have been obtained from the subscriber A during the user interaction or selected according to the instructions from the subscriber A, or the number may have been obtained by some other method.

Upon receiving the message CON, the SSP/MSC sends an ISUP facility message FAC to the PSTN gw-MSC on the first leg (i.e. towards the
15 subscriber A). In accordance with the present invention, the message FAC contains control information which causes the PSTN gw-MSC to connect the echo canceling equipment to a line. The SSP/MSC has determined that echo canceling is needed because the new subscriber C is a mobile station MS.

Prior to, simultaneously with, or after sending the message FAC, the SSP/MSC carries out a normal call setup to the mobile station C. As the
20 call to be setup is a speech call, echo canceling is automatically used in the mobile station MS. Then the subscriber C answers normally and call configuration is completed as shown in Figure 2. The old call configuration is shown by a dashed line in Figure 2.

The ISUP facility message is defined in ITUT-recommendation Q.763, table 45. The new echo-canceller-control parameter for the purposes of the present invention can be defined to be one of the optional parameters. Other parameters which may be required in the echo canceller control are the
30 message type, message compatibility information, and parameter compatibility information in the facility message. It should be noted, however, that the control information according to the present invention can be sent using any message which can be sent in a speech state during an active call.

Another reason for using call configuration according to Figure 1
35 may be that the subscriber A has called to a service number in a mobile communications network, and the call has resulted in a IN service request to the

SCP in a signaling phase, and then the SCP has commanded that the call should be routed to the PSTN subscriber B. In this case, the SSP would likely report the release of the second leg using an event report BCSM (ERB) message instead of an IDP message.

5 As noted above, the need for echo canceling may change also when the call type is changed during an active call. The possible call types may include a speech mode, a facsimile mode, and a data transmission mode, for example. In the following, the invention will be illustrated by using a speech/fax call as an example. Figure 4 illustrates a speech/fax call established from a mobile subscriber A via a serving MSC and a PSTN gw-MSC to the PSTN subscriber B. The PSTN gw-MSC is provided with echo canceling equipment which can be connected to the call when needed. The MSC has no echo canceling equipment. Normally, when establishing a speech call, the GSM traffic channel between the mobile station MS and the serving MSC is in a speech mode using speech encoding. The transmission leg between the serving MSC and the PSTN gateway MSC is typically a PCM link, and a typical PSTN connection (or ISDN connection) is provided between the PSTN gw-MSC and the PSTN subscriber B. As the call is established in a speech state, the echo canceling equipment is also needed and connected to the line in the PSTN gateway-MSC. However, upon establishing the call initially in a speech mode, the mobile station may automatically or due to the user intervention, change the call type into a facsimile mode. The facsimile mode means that the traffic channel between the MS and MSC is in a data mode and specific facsimile adapters are provided at the ends of the connection. The echo canceling is not allowed in the facsimile call since the signal is distorted by the echo canceling, and thus the facsimile transmission has deteriorated or failed. Therefore, the echo canceling equipment should be disconnected from the line in the PSTN gw-MSC. On the other hand, if the call were later returned to the speech mode, the echo canceling equipment should be connected back to the line.

Figure 5 is a signaling diagram illustrating the echo canceller control according to the present invention in a speech/facsimile call. Firstly, the MS changes the call type from the speech to the facsimile mode in the mobile equipment (step 51). The MS initiates the change of the GSM traffic channel from the speech mode to the facsimile mode by signaling to the MSC (step 52). The MSC changes the mode of the traffic channel, and in accordance with

the present invention, sends an ISUP facility message FAC containing the echo canceller control information to the PSTN gateway-MSC (step 53). Reacting to the received control information, the PSTN gw-MSC disconnects the echo canceller from the outbound circuit of the connection (step 54). As a result, successful facsimile transmission can be initiated.

Later in the call the mobile station MS initiates a change back to the speech mode (step 55). The MSC changes the GSM traffic channel from the facsimile mode into the speech mode and, in accordance with the present invention, sends an ISUP facility message FAC containing the echo canceller control information to the PSTN gw-MSC. Reacting to the echo canceller control information, the PSTN gw-MSC connects the echo canceling equipment back to the outbound circuit of the connection (step 57).

It is also possible to disconnect the echo canceller from the line when facsimile signaling is detected by the echo canceller or the PSTN gw-MSC. However, in this case the echo canceller cannot be connected back to the line when the call is changed back to the speech mode, and thus an echo will be present in the call in the prior art systems. Also, this problem can be avoided by an embodiment of the present invention wherein the serving MSC, when changing the mode of GSM traffic channel, commands the PSTN gw-MSC to connect the echo canceller to the line. This corresponds to steps 55-57 in Fig. 5. However, when changing from a speech mode to a facsimile mode, the echo canceller independently detects the facsimile mode and leaves the connection. In other words, the steps 52-53 of Fig. 5 are not needed in this embodiment.

The application has been described above by means of the preferred embodiments to illustrate the principles of the invention. The details of the invention may vary within the scope and spirit of the accompanying claims.

Claims

1. A method for controlling echo canceling in a telecommunications network comprising a first switching center having no echo canceling equipment and at least one second switching center having echo canceling equipment, said method comprising a step of

5 establishing a call connection which is routed via said first switching center and said at least one second switching center without connecting the echo canceling equipment to the connection,

characterized by further steps of

10 changing, under control of said first switching center, a configuration of the call connection so that echo canceling becomes necessary,

sending to said at least one second switching center from said first switching center a message commanding said at least one second switching center to connect the echo canceling equipment to the connection.

15 2. A method according to claim 1, wherein said telecommunications network is a mobile communications network, said first switching center is a mobile switching center, and said at least one second switching center is a gateway mobile switching center connecting said mobile communications network to a fixed telephone network, **characterized** by steps of

20 establishing said call connection initially between a first fixed telephone network party and a second fixed network party through said first mobile switching center and said gateway mobile switching center without any echo canceling equipment being connected to the call connection in said gateway mobile switching center,

25 releasing a connection leg between said first mobile switching center and the second fixed network party,

establishing, under control of said first mobile switching center, a new connection leg to a mobile station in the mobile communications network so that an end-to-end connection between the first fixed telephone network party and the mobile station is provided through the first and gateway mobile switching centers,

30 sending to said gateway mobile switching center from said first mobile switching center a message commanding said gateway mobile switching center to connect the echo canceling equipment to the connection.

3. A method according to claim 1 or 2, **characterized** by said message being an ISUP Facility message provided with a specific field for controlling the connecting of the echo canceling equipment.

5 4. A method according to claim 1, 2 or 3, **characterized** by a step of controlling the call in said first switching center by an intelligent network.

5. A method according to claim 4, **characterized** by a step of performing said release of the connection leg to the second fixed network party and said establishment of the new connection to the mobile station during a call party handling procedure of the intelligent network.

6. A method according to claim 2, 3 or 4, **characterized** by said step of releasing the connection leg between said first mobile switching center and the second fixed network party being performed in response to a release initiated by the second fixed network party, preferably a voice mail service.

7. A method for controlling echo canceling in a telecommunications network comprising a first switching center having no echo canceling equipment and at least one second switching center having echo canceling equipment, said method comprising a step of

20 establishing a call connection in a speech mode via said first switching center and said at least one second switching center so that the echo canceling equipment is connected to the connection,

characterized by further steps of

changing, under control of said first switching center, the type of call

25 connection from the speech mode to another transmission mode in which echo canceling is not allowed,

sending to said at least one second switching center from said first switching center a signaling message commanding said second switching center to disconnect the echo canceling equipment from the connection.

30 8. A method according to claim 7, **characterized** by steps of changing, under control of said first switching center, the type of the call connection from said other transmission mode back to the speech mode,

sending to said at least one second switching center from said first switching center a signaling message commanding said second switching

center to connect the echo canceling equipment to the connection.

9. A method according to claim 7 or 8, **characterized** in that said telecommunications network is a mobile communications network, said first switching center is a mobile switching center, and said at least one second switching center is a gateway mobile switching center connecting said mobile communications network to a fixed telephone network.

10. A method according to claim 9, **characterized** by steps of

establishing said call connection between a mobile station and a second fixed network subscriber through said first mobile switching center and said gateway mobile switching center with echo canceling equipment being connected to the call connection in said gateway mobile switching center,

changing, under control of said mobile switching center, the type of call connection from the speech mode to said other transmission mode in which echo canceling is not allowed,

sending to said gateway mobile switching center from said first mobile switching center said signaling message commanding said gateway mobile switching center to disconnect the echo canceling equipment from the connection.

11. A method according to claim 9, **characterized** by steps of

changing, under control of said mobile switching center, the type of the connection from said other transmission mode back to the speech mode,

sending to said gateway mobile switching center from said first mobile switching center said signaling message commanding said gateway mobile switching center to connect the echo canceling equipment to the connection.

12. A method according to any one of claims 7-11, **characterized** in that said other transmission mode is a facsimile mode or a data transmission mode.

13. A communications network, comprising a first switching center (MSC) having no echo canceling equipment and at least one second switching center (PSTN gw-MSC) having echo canceling equipment, said first switching center (MSC) being capable of changing the call party during the call by releasing a connection leg to an old party and establishing a new connection leg

to a new party, **characterized** by

the first switching center (MSC) is arranged to send, in response to the change of call party, to said at least one second switching center (PSTN gw-MSC) a signaling message (FAC) commanding said second switching center to connect the echo canceling equipment to a call connection, when
5 there is no echo canceling equipment already connected to the call connection and echo canceling is required due to the new party.

14. A network according to claim 13, **characterized** in that said communications network is a mobile communications network, said first
10 switching center is a mobile switching center (MSC), and said at least one second switching center (PSTN gw-MSC) is a gateway mobile switching center connecting said mobile communications network to a fixed telephone network.

15. A network according to claim 14, **characterized** in that said call connection initially comprises a first connection leg from the first mobile switching center (MSC) via said gateway mobile switching center (PSTN gw-MSC) to a first fixed telephone network party, and a second connection leg from the first mobile switching center (MSC) to a second fixed telephone network party, and that the first mobile switching center is arranged to release the
20 second connection leg in response to a release message sent by the second fixed telephone network party, and to establish a new connection leg from the first mobile switching center (MSC) to a mobile subscriber (MS), said new connection requiring echo canceling.

16. A network according to claim 14, **characterized** in that said said call connection initially comprises a first connection leg from the first mobile switching center (MSC) via said gateway mobile switching center (PSTN gw-MSC) to a first fixed telephone network party, and a second call connection leg from the first mobile switching center (MSC) via said gateway mobile switching center (PSTN gw-MSC) to a service node, preferably a voice
30 mail service, and that the first mobile switching center is arranged to release the second connection leg in response to a release message sent by the service node, and to establish a new connection leg from the first mobile switching center (MSC) to a mobile subscriber (MS), said new connection requiring echo canceling.

35 17. A network according to any one of claims 12-16, **charac-**

terized by said message (FAC) being an ISUP Facility message provided with control information for controlling the connecting of the echo canceling equipment.

5 18. A network according to any one of claims 13-17, **characterized** by said first switching center (MSC) being connected to a service control point in an intelligent network.

19. A network according to claim 18, **characterized** by said first switching center (MSC) being arranged to perform the change of a call party by a call party handling procedure of the intelligent network.

10 20. A communications network comprising a first switching center (MSC) having no echo canceling equipment and at least one second switching center (PSTN gw-MSC) having echo canceling equipment, said first switching center (MSC) being capable of changing the call type from a speech mode to another transmission mode during the call, **characterized** by

15 the first switching center (MSC) is arranged to send, in response to said change of call type from said speech mode to said other transmission mode, to said at least one second switching center a signaling message (FAC) commanding said second switching center (PSTN gw-MSC) to disconnect the echo canceling equipment from a call connection, when said call connection is
20 routed via said second switching center. 8(MSC) (PSTN gw-MSC) (MSC) (MSC) (PSTN gw-MSC) (FAC)

21. A network according to claim 20, **characterized** in that said telecommunications network is a mobile communications network, said first switching center is a mobile switching center (MSC), and said at least one
25 second switching center is a gateway mobile switching center (PSTN gw-MSC) connecting said mobile communications network to a fixed telephone network.

22. A network according to claim 20 or 21, **characterized** in that said other transmission mode is a facsimile mode or a data transmission
30 mode.

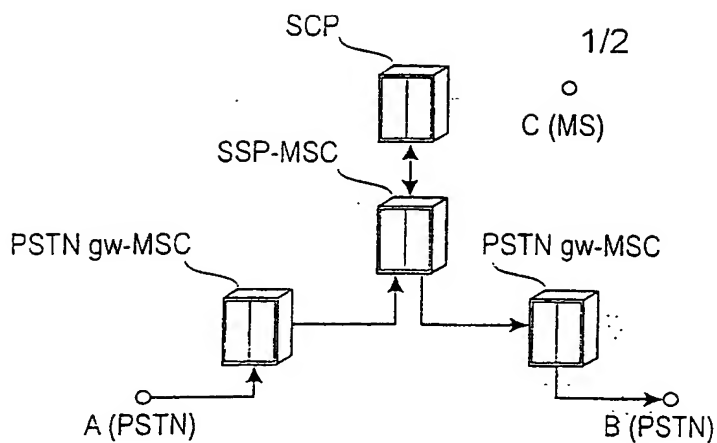


Fig. 1

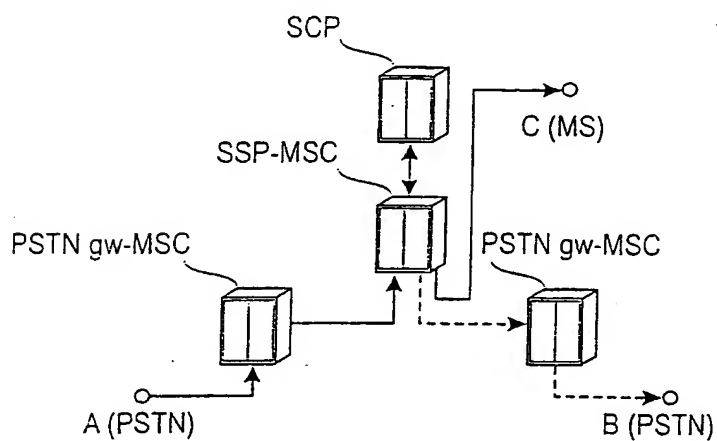


Fig. 2

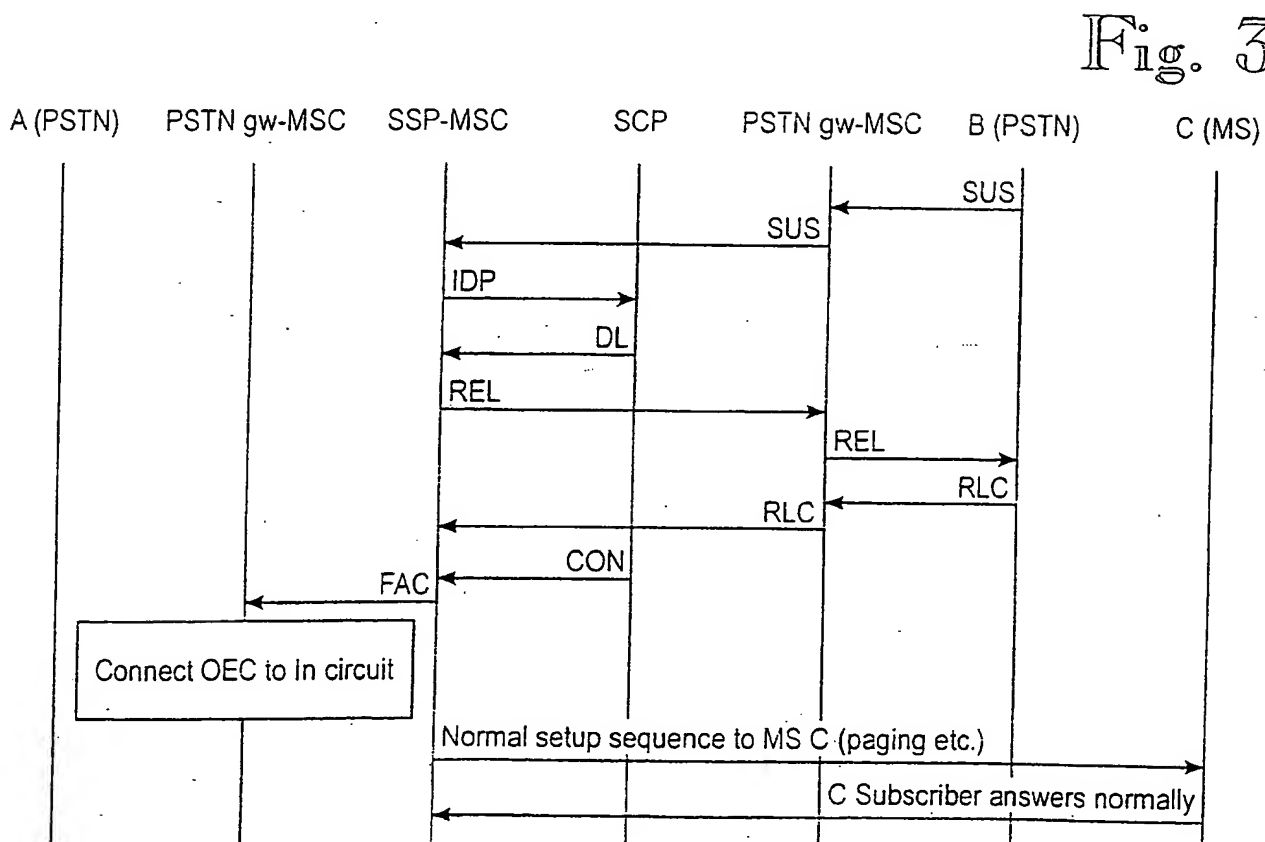


Fig. 3

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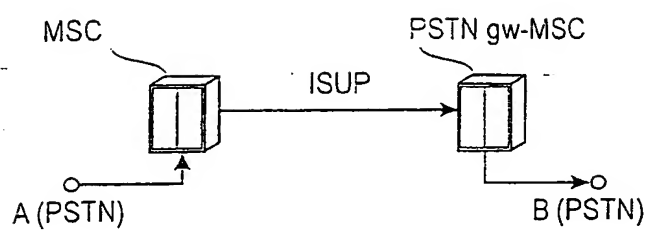
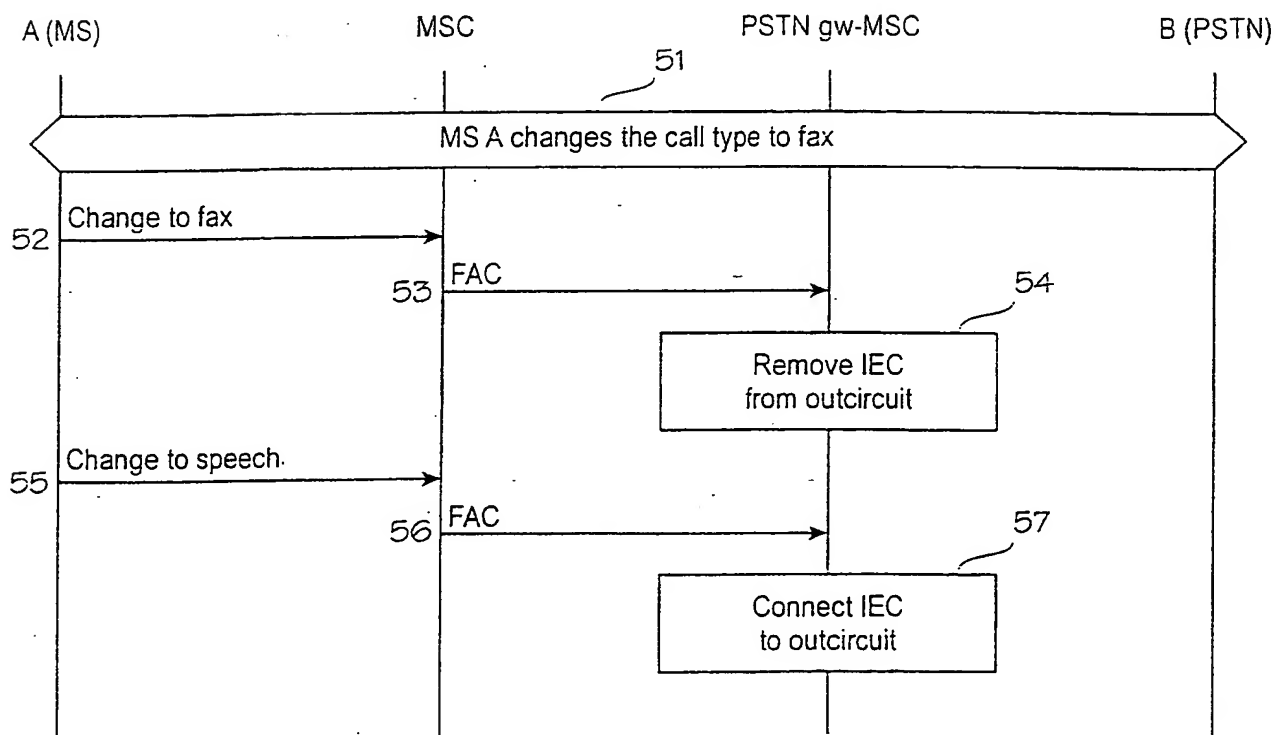


Fig. 4

Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00815

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 3/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0920172 A1 (ALCATEL), 2 June 1999 (02.06.99), column 1, line 52 - column 2, line 4; column 2, line 26 - line 48	1,7
Y		2-6
A		8-22
	--	
Y	US 5953658 A (R.E. SCOTT), 14 Sept 1999 (14.09.99), figure 3, abstract	2-6
A		8-12
	--	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

19 December 2000

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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9-55964 A (FUJITSU LTD), 25 February 1997
(25.02.97)

1-22

INTERNATIONAL SEARCH REPORT

Information on patent family members

04/12/00

International application No.

PCT/FI 00/00815

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP	0920172 A1	02/06/99	NONE	

US	5953658 A	14/09/99	NONE	
